ATTACHMENT Q PLUGGING AND ABANDONMENT PLAN

Q.1 WELL PLUGGING AND ABANDONMENT PLANS

General well closure procedures and any post-closure care plans are detailed in the following subsections. These procedures follow the requirements outlined under California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) Onshore Well Regulations for proper well abandonment (State of California, California Code of Regulations, Title 14 – Natural Resources, Division 2 – Department of Conservation, March 2007) and the procedures will be consistent with the requirements of 40 CFR § 146.10. A temporary abandonment program will be included as part of the well book prior to commencement of operations, while an exact final plugging and abandonment program will be developed prior to actual well abandonment. The detailed plan, to be submitted on EPA Form 7520-14, will be based on final "as-built" well construction and the specific zone(s) perforated and used for the pilot test in each well. The well-specific plan will include: 1) information on type, number, and placement of the proposed plugs; 2) type, grade, and quality of the cement(s) to be used; and, 3) the method that will be used to place the plugs. The plan will be submitted a minimum of 60 days in advance of well plugging for review and approval. In general, the program will be designed such that cement plugs are spotted to protect oil and gas resources, to prevent degradation of usable water sources, and to protect the surface.

Downhole pressure and temperature sensors will be installed in the Injection Well and the Observation Well when the tubing is installed, allowing for the monitoring of pressure and temperature during both the active injection phase and the subsequent falloff phase following secession of injection activity. The post-injection monitoring phase may last several months to allow the injected CO_2 plume to stabilize and the injection interval to recover back to its natural condition. Since the decay in pressure in the Injection interval will be carefully monitored, no post-closure monitoring is planned.

Q.1.1 Temporary Well Abandonment Procedures

After the completion of the pilot test, the wells will be actively monitored for a minimum period of 6 months, to allow the injected CO_2 plume to stabilize and the injection interval to recover back to its natural condition and then they will be temporarily abandoned. The temporary abandonment procedures shall follow the requirements outlined under California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) Onshore Well

Regulations for proper well abandonment (State of California, California Code of Regulations, Title 14 – Natural Resources, Division 2 – Department of Conservation, March 2007):

A. Notice of intent to plug will be made at least 60 days prior to planned closure. The following detailed information will be provided (EPA Form 7520-14) at that time:

1. Type and number of plugs.
2. Placement of each plug, including the elevation of both the top and bottom of the plug.
3. Type, grade, and quantity of the plugging material and additives to be used.
4. Method used to place plugs in hole.
5. Procedure used to temporarily abandon the well.

B. Temporary Abandonment operations for the pilot well(s) will, at a minimum, be conducted as follows (see Figure Q-1):

1. Move workover rig onto location.
2. Kill well with appropriate fluid to overbalance the formation Remove wellhead and nipple up blow out preventers.
3. Pull injection tubing, injection packer(s), and downhole instrumentation from the well.
4. Run in the well open-ended and circulate the well with kill fluid for the temporary.
5. Set a cement retainer above the perforated zone and squeeze off perforations with cement. Release from cement retainer and reverse circulate any excess cement from the well. Pressure test against the cement retainer and casing to confirm closure/seal of the perforations.
6. Run in well open-ended and place a cement plug from the top of the retainer to ensure that all flow paths are closed off. The cement plug will extend at least 200 feet above the top of the retainer.
7. Allow cement to set and tag top of plug to verify depth. Following tagging of plug top, pressure up on the plug to 1,000 psi for at least 30 minutes in order to verify integrity of the protection casing and the cement plug. Record and

chart the pressure test. Note EPA and DOGGR may witness the casing/cement pressure test.

8. Run in hole and set a retrievable bridge plug 10 feet above the top of the cement plug.
9. Displace hole completely with appropriate fluid sufficient to over balance the formation by at least 150 psi.
10. Pull out of hole and leave a minimum 1,000 feet (exact footage will depend on pressures observed during the pilot test) of kill string in the hole.
11. Close all wellhead valves and install pressure gauges for monitoring of both the "A" and "B" annulus.

A temporary abandonment report will be filed with the EPA and DOGGR within 30 days after completion of operations.

Q.1.2 Final Abandonment and Plugging Procedures

At the end of field life, the Injection and the Observation Wells will be completely abandoned and decommissioned. The general procedures for well closure are described below and may be modified prior to performing field operations according to the direction of the EPA and/or DOGGR:

A. Notice of intent to plug will be made at least 60 days prior to planned closure. The following detailed information will be provided (EPA Form 7520-14) at that time:

1. Type and number of plugs.
2. Placement of each plug, including the elevation of both the top and bottom of the plug.
3. Type, grade, and quantity of the plugging material and additives to be used.
4. Method used to place plugs in hole.
5. Procedure used to plug and abandon the well.
6. Any information on newly constructed or discovered wells, or additional well data, within the Area of Review.

B. Plugging operations for the pilot well(s) will, at a minimum, be conducted as follows (Figure Q-1):

1. Move workover rig onto location.
2. Kill well with appropriate fluid to overbalance the formation. Remove wellhead and nipple up blow out preventers.
3. Pull injection tubing, injection packer(s), and downhole instrumentation from the well.
4. Run in the well open-ended and displace the well with plugging mud for the permanent abandonment. Per State of California, California Code of Regulations, Title 14, Division 2, Chapter 4, Article 3, 1732 (b) [March 2007], the plugging mud must be of sufficient density and consistency to exert hydrostatic pressure exceeding the greatest formation pressure encountered while drilling that interval and prevent movement of fluids into the wellbore.
5. Set a cement retainer above the perforated zone and squeeze off perforations with cement. Release from cement retainer and reverse circulate any excess cement from the well. Pressure test against the cement retainer and casing to confirm closure/seal of the perforations.
6. Run in well open-ended and place a cement plug from the top of the retainer to ensure that all flow paths are closed off. The cement plug will extend at least 200 feet above the top of the retainer.
7. Allow cement to set and tag top of plug to verify depth. Following tagging of plug top, pressure up on the plug to 1,000 psi for at least 30 minutes in order to verify integrity of the protection casing and the cement plug. Record and chart the pressure test. Note EPA and DOGGR may witness the casing/cement pressure test.
8. Spot a high-viscosity pill below the freshwater-saltwater interface (at surface casing shoe). Place a 200 foot cement plug across the freshwater-saltwater interface (surface casing shoe). Wait on cement to set and tag top of cement to confirm depth.
9. Final cement plug at surface should be at least 200 feet in length, measured below the intended casing cut-off point (or as close as practical). All

uncemented casing annuli should also be plugged with cement or removed to a depth below the intended surface plug.

10. Cut off casing five to ten feet below ground surface (or depth as designated by the surface owner with approval of the Director) and fill any and all open annular spaces with cement.
11. Weld steel plate on top of the cut casing around the circumfrence of the casing. Plate is to be at least as thick as the outer well casing and inscribed with the well identification (last five digits of the assigned API well number).

An abandonment and plugging report will be filed with the EPA and DOGGR within 30 days after completion of operations.

Q.1.3 General Well Abandonment and Plugging – Unsuitable Well

In the event that the data from the Injection Well drilling indicates that the site is unsuitable for the pilot test, the well will be abandoned following the completion of the open-hole evaluation program, prior to moving the drilling rig off of location.

A. Abandonment and plugging operations for the well will, at a minimum, be conducted as follows:

1. Pull evaluation equipment from the well.
2. Run in the hole open ended and place a cement plug from at least 50 feet below the intermediate casing shoe to at least 50 feet above the intermediate casing shoe.
3. Allow cement to set and tag top of plug to verify depth. Wait on cement to set and tag top of cement to confirm depth. Following tagging of plug top, pressure up on the plug to 1,000 psi for at least 30 minutes in order to verify integrity of the cement plug. Record and chart the pressure test. Note EPA and DOGGR may witness the casing/cement pressure test.
4. Spot a high-viscosity pill below the freshwater-saltwater interface (surface casing shoe). Place a minimum 100 foot cement plug across the freshwater-saltwater interface in the intermediate casing. Wait on cement to set and tag

top of cement to confirm depth. Wait on cement to set and tag top of cement to confirm depth.

5. Final cement plug at surface should be at least 25 feet in length, measured below the intended casing cut-off point. All uncemented casing annuli should also be plugged with cement or removed to a depth below the intended surface plug.
6. Cut off casing five to ten feet below ground surface (or depth as designated by the surface owner with approval of the Director) and fill any and all open annular spaces with cement.
7. Weld steel plate on top of the cut casing around the circumfrence of the casing. Plate is to be at least as thick as the outer well casing and inscribed with the well identification (last five digits of the assigned API well number).

A plugging report will be filed with the EPA and DOGGR within 30 days after completion of operations